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https://www.chemistryworld.com/opinion/how-values-influence-decisions-in-science/4013532.article

Great Expectations[1]

Science is an activity which involves making choices. Scientists choose which hypothesis will be put to the test, what assumptions or approximations are deemed acceptable, which model will be used for describing a specific system, and so forth. Inevitably, such decisions are based on upholding certain values.

Why do we want anything more than empirical adequacy?

First and foremost, for a theory to be deemed acceptable, it must be the case that it complies with our empirical evidence. If what a theory predicts does not comply with what we observe, then obviously, there is something wrong with that theory.

Having a theory agree with and explain in a consistent manner the available observations seems to be all one can (and should) require by a theory. However, here comes a problem.

Philosophers – most notably Pierre Duhem – have pointed out a quite simple yet particularly worrying feature of scientific practice: the data we gather from experimenting is consistent with more than one way of understanding the world around us. Put differently, there is no single, unique theory or hypothesis which fits with our empirical evidence. There are conceived and unconceived alternatives which are equally compatible with our observations and experimental results. This is called the underdetermination problem and it is one of the most interesting but also challenging issues in philosophy of science.

This problem explains to a degree why values figure in science. Being consistent with empirical data is often not sufficient so as to decide which of the available hypotheses correctly explains a phenomenon. So scientists need to turn to other criteria. Most notable is the value of simplicity (Baker 2016). A theory which does not posit too many entities, or which is not too complicated (at least compared to other available theories), is usually regarded as being closer to how things are. This of course reveals an implicit – and not always undisputed – assumption about the world itself: namely that the world is simple, without unnecessarily many things in it!

The periodic table

An interesting example of the importance of values comes from chemistry itself. The development of the periodic table went through significant shifts due to the different values upheld by its various designers. Mendeleev wished the periodic table to be as complete as possible, and thus designed it in such a way as to incorporate many elements, including undiscovered ones (Pulkkinen 2020: 175). On the other hand, Newlands designed the periodic system with the aim to illuminate a simple relation among the known elements (Pulkkinen 2020: 175). Other values which figured in the design of the periodic table include rigour, carefulness with respect to the data, the ability to predict new elements, as well as the ability to illustrate qualitative similarities among groups of elements (Pulkkinen 2020: 197).

Do values undermine the objectivity of science?

While some philosophers have argued that admitting values in scientific practice undermines science's objectivity, this is not currently the received view (Reiss and Sprenger 2020). Objectivity does not imply that scientists do not have rational grounds for making specific choices. After all, objectivity and being close to the truth are themselves values that scientists wish for their theories to exemplify. So the question is not so much whether we should accept values in science, but rather which values should be admitted and what should be their role in science.

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[1] Final version of this article can be found here: https://www.chemistryworld.com/opinion/how-values-influence-decisions-in-science/4013532.article

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